FLOWSERVE

Worcester Actuation Systems

WCAIM2050

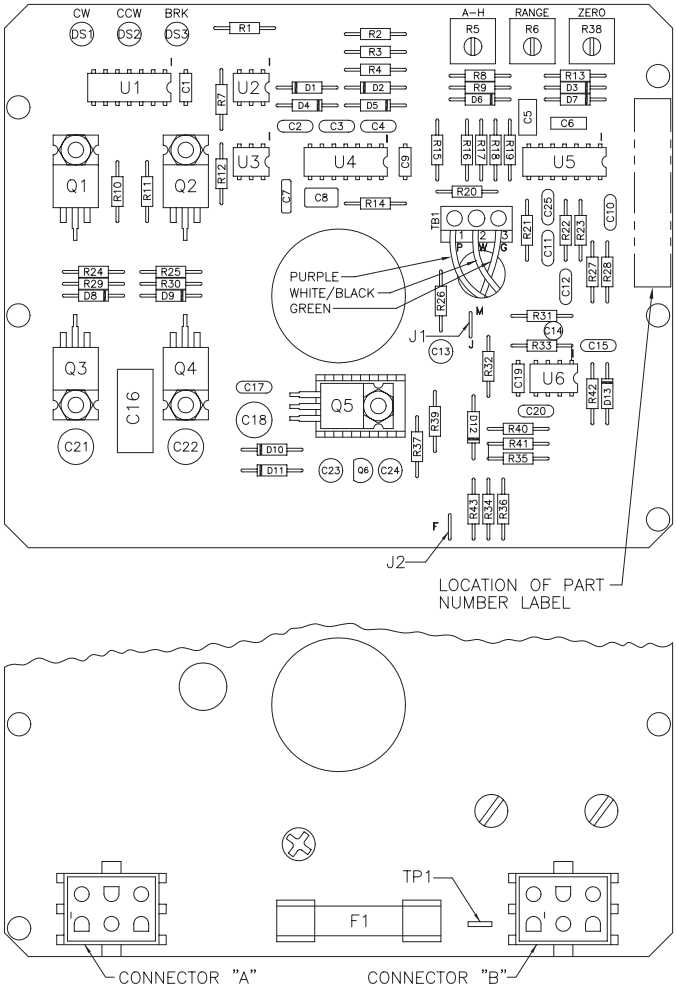
DC AF-17 Electronic Positioner

Installation, Operation and Maintenance Instructions

A. GENERAL

This supplement to the AC AF-17 IOM covers the DC AF-17 circuit board. This supplement will cover those features of the DC board that are different than the AC version.

Figure 1 – 12 and 24 VDC Positioner Circuit Board



Use or value of components R13, R26, R34, R35, R36, J1 and J2 will vary depending on circuit board input.

There are two major differences between the AC and DC versions of the AF-17 board. The first of these is the fact that the DC AF-17 board is plug connected to the actuator terminal strip as opposed to being wired directly into the terminal strip. This makes it much easier to install or remove the circuit board for adjustments, repairs, etc. The baseplate in the 75 Series Actuator is wired differently for the DC versus the AC AF-17 board, and the two are not interchangeable. The DC baseplate has connector plug assemblies wired into the terminal strip, and the limit switches are wired into the connector plug assemblies. The second major difference is that this board is powered directly with DC voltage versus AC voltage. This board can be powered with either 12 or 24 volts DC with no changes needed to the circuit board. The only caution in this regard is that the proper motor(s) be used for the voltage applied.

***IMPORTANT**: All of the cautions and notes in the AC AF-17 IOM should be read prior to installing this board in a 75 Series Actuator.*

B. CAUTIONS

PLEASE READ THIS SECTION

1. Power Rating

   At this time, the DC AF-17 board has been approved for use in size 10 through 23 75 Actuators only.

2. ***NOTE:** Fusing Protection for input circuits as found on earlier DC boards only.*

   Earlier version of DC AF-17 boards are protected with a 62 mA fuse (F2) and a 12 volt zener diode (CR18) installed across the input circuit. These two devices in combination are designed to protect the CMOS chip from both an overvoltage condition and reverse polarity of the input signal. For earlier version using a 4-20 mA signal input circuit, the signal input impedance of the AF-17 board is approximately 220 ohms which means that it only takes about 4.5 volts to drive 20 mA through the input circuit. If your current source is capable of outputting 12 volts or more, it may be necessary to place a ¼ watt resistor in series with the current loop to drop the excess voltage, otherwise you might find that you keep blowing the input

protection fuse. This is most likely to happen when you initially turn on your current source, i.e., before it starts regulating its output current. For example, let's say you measure an open circuit voltage from your current source of 24 volts. Apply the following formula to determine the value of the resistor to be added in series with the current loop:

R = [24 volts - (.05 × 220 ohms)] /.05

This calculation may yield a resistor value that is not a common standard value. Select a resistor of the next higher standard value (i.e., if your calculation result is a value of 260 ohms, as in the above example, then pick the next higher standard resistor value which in this case would be 270 ohms). This will ensure that enough voltage will get dropped across the added resistor at 50 mA, to prevent the zener diode from turning on and causing the fuse to blow. If there are other devices in the current loop such as a chart recorder or digital readout, then their input resistances must be added to the input resistance of the AF-17 board (in the above formula, 220 ohms would be replaced by the total loop resistance). If the calculation results in a zero or a negative resistance value, then no additional series resistor is needed. The fuse (F2) used in the input circuit is a Littlefuse PICO II very fast acting fuse rated at 62 mA. There is a spare fuse located near the top edge of the circuit board between the two connectors.

All DC versions of the AF-17 board use a standard 1¼" 250 volt, 3 amp fuse (F1) to protect the circuit board and the power source in case of a fault in the H-bridge circuit on the circuit board. The H-bridge circuit is the DC polarity and power switching circuit for the DC motor(s).

CAUTION: It is important that the DC voltage power source be connected properly to the actuator's terminal strip. Terminal one (1) of this strip is to have the negative wire connected to it. Terminal two (2) is to have the positive wire connected to it (See Figure 3 on page 4.). As stated above, earlier versions of the board have a diode and a fuse installed to prevent damage, as in the case of reverse voltage polarity, but if the diode happens to be defective, damage could be done before the fuse blows.

***NOTE**: All wiring to terminal strip should be inserted only to mid-point of terminal strip.*

3. Floating Input Signal

   The AF-17 board has been designed to receive a floating current input signal as standard from the factory. This allows several pieces of equipment to be operated from the same current loop while at the same time remaining electrically independent of each other. A floating input signal means that the current input signal should not be referenced to the circuit board ground. This is especially important with DC powered circuit boards. The board power source must have a ground independent from that of the signal source.

4. Quadrants of Operation (Refer also to Page 4 of AC AF-17 IOM)

   The AF-17 board can be set up in several ways for normal operation. The board is designed to control in 90° quadrants only. The number of quadrants over which the board will control is determined by the number of teeth on the feedback potentiometer pinion gear. The adjustment trimpots on the board were not set up to reduce actuator travel for a 4 - 20 mA input span. For example, trying to adjust the board such that 4 mA is closed and 20 mA is only 60% open is just not possible with the standard setup.

   The standard setups are:

   1) 4 mA for full clockwise rotation – i.e., 0° and 20 mA for full counterclockwise rotation – i.e., 90° or 180°.

   2) Split range where 4 mA would be full clockwise and 12 mA would be full counterclockwise or 12 mA would be full clockwise and 20 mA would be full counterclockwise.

   3) Each of the above standard setups can also be made reverse acting.

4. Feedback Potentiometer Calibration

   Quite often when we receive an actuator for repair at Flowserve we find that the only thing wrong with the unit is that the feedback potentiometer is out of calibration. It is very important that the feedback potentiometer be properly calibrated for correct operation of the positioner board. It is also very important that the actuator shaft not be rotated out of the quadrant for which the feedback potentiometer has been calibrated. Whenever you have a problem with positioner calibration, always check the feedback potentiometer calibration first. This must be done with no power applied to the circuit board. If the actuator is in the full clockwise position, check the resistance between the purple and white/black potentiometer leads. The reading should be 80-90 ohms. If it is not, rotate the face gear until the proper reading is achieved. NOTE: It is *not* necessary to loosen or remove face gear snap ring to rotate gear, it is a friction fit. If for any reason the snap ring(s) are to be removed, do *not* over stretch them; use minimum opening to allow them to slip over the gear. If the actuator happens to be in the full counterclockwise position then check the resistance between the green and white/black potentiometer leads. If necessary, adjust the face gear for an 80-90 ohm reading.

C. INSTALLATION OF DC AF-17

1. General

   If the actuator was purchased with the DC AF-17 positioner board factory installed, proceed to section 4.0.

a. Check kit for parts:

COMMON PARTS FOR SIZES 10-23

Qty.	Name	Qty.	Name
1	Circuit Board Subassembly	1	Nameplate – Circuit Board
1	Pot Kit Subassembly	1	Bracket – Left (Short)
1	Insulating Board	1	Nameplate – Base
1	Wiring Label – Cover	10	Spacers (Bracket) (Various Lengths)
5	Washers (Nylon)	1	Closed End Splice
1	Instruction Manual	8	Mounting Screws (Bracket/Spacer) (Various Lengths)
5	Grommets (Rubber)	2	Connector Cable Assemblies (One 'A' and One 'B' Assembly)
5	Cable Ties		
5	Mounting Screws		
1	Bracket – Right (Long) (Circuit Board)		

b. Tools Needed:

¼" nut driver, ⅛" screwdriver, needle nose pliers, 1/16" Allen wrench (cams and spur gear), Volt/Ohmmeter (checking feedback potentiometer resistance, voltages, incoming control signal).

2. Feedback Potentiometer Connections

The feedback potentiometer is connected to the circuit board at the terminal block on the DC AF-17 circuit board by leading the feedback potentiometer wires up through the 5/16" hole near the terminal block; green wire to terminal 3, white/black wire to terminal 2, and purple wire to terminal 1. If a dual feedback potentiometer is installed in the actuator, then the front or 'A' section of the feedback potentiometer is wired to the circuit board as mentioned above and the back or 'B' section of the feedback potentiometer is wired to the actuator terminal strip with the green wire connected to terminal 7, the white/black wire connected to terminal 8, and the purple wire connected to terminal 9. Be certain to route the wires such that they cannot become caught in either the switch arms or the feedback potentiometer drive gears. NOTE: Voltage limit of "B" potentiometer is 30 volts maximum.

3. Mounting Circuit Board:

For 12/24 VDC 10-23 Size Electric Actuators: (See Figures 2 and 3).

1) Pre-tap circuit board bracket holes with the self-tapping circuit board mounting screws (item 5). Remove the outside corner motor screws and mount the brackets to the appropriate spacers using the self-tapping spacer/bracket mounting screws (item 8) being careful, to avoid stripping the threaded holes in motor base. The longer bracket is mounted to the right side of the actuator when facing the terminal strip.

***NOTE**: The proper length spacers and screws must be used based on the actuator size:*

10,12 size actuators having single motor will use the two shortest spacers on motor side and two intermediate length spacers on the opposite side, and four of the shorter spacer/bracket mounting screws.

20,22 size actuators have two motors and use four of the shortest length spacers and four of the shorter spacer/bracket mounting screws.

23 size actuators also have two motors but will use four of the longest length spacers and four of the longest length spacer/bracket mounting screws.

2) Once these screws and brackets are firmly secured, firmly tap the motor stators with a plastic-faced hammer to force realignment of the motor bearings.

3) Loosen all terminal strip screws and install the A and B connector cable assemblies into the actuator terminal strip. See figure 3 (next page) for proper wiring of cable assemblies to terminal strip. Wire routing is important. Ensure that wiring is not pinched and is not touching any moving parts such as cams or switch arms.

4) Assemble circuit board into actuator. Slide rubber grommets onto insulating board. Put nylon washers under heads of self-tapping screws (Five screws will be used to install the circuit board onto the brackets).

5) Place the circuit board over the brackets with the insulating board between the circuit board and the mounting brackets. Loosely tighten the four screws securing the board and insulator. Use a nylon washer and a rubber grommet on the self-tapping screw securing the right front corner of circuit board (as you face the terminal strip). Place the rubber grommet between the circuit board and the mounting bracket. Tighten all the mounting screws so that the grommets are about half compressed.

6) The baseplate in the DC actuator is wired differently than that in the AC actuator. Once the circuit board is mechanically installed, it is then necessary to plug in the two connector cables from the baseplate to the circuit board. The connector with the blue, yellow, and brown wires (plus three additional wires) is plugged into the circuit board connector next to the main power fuse. The connectors are polarized so that thay are plugged correctly (i.e., pin 1 to pin 1, etc.).

D. CALIBRATION

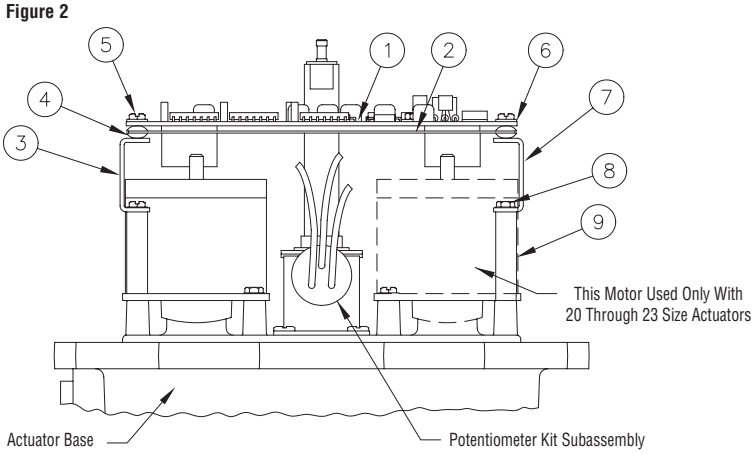
Refer to AC AF-17 IOM Section 4.0

***NOTE**: LED designations DS1, DS2, and DS3 on DC circuit board are equivalent to LD2, LD1, and LD3 on AC circuit board respectively.*

E. MISCELLANEOUS

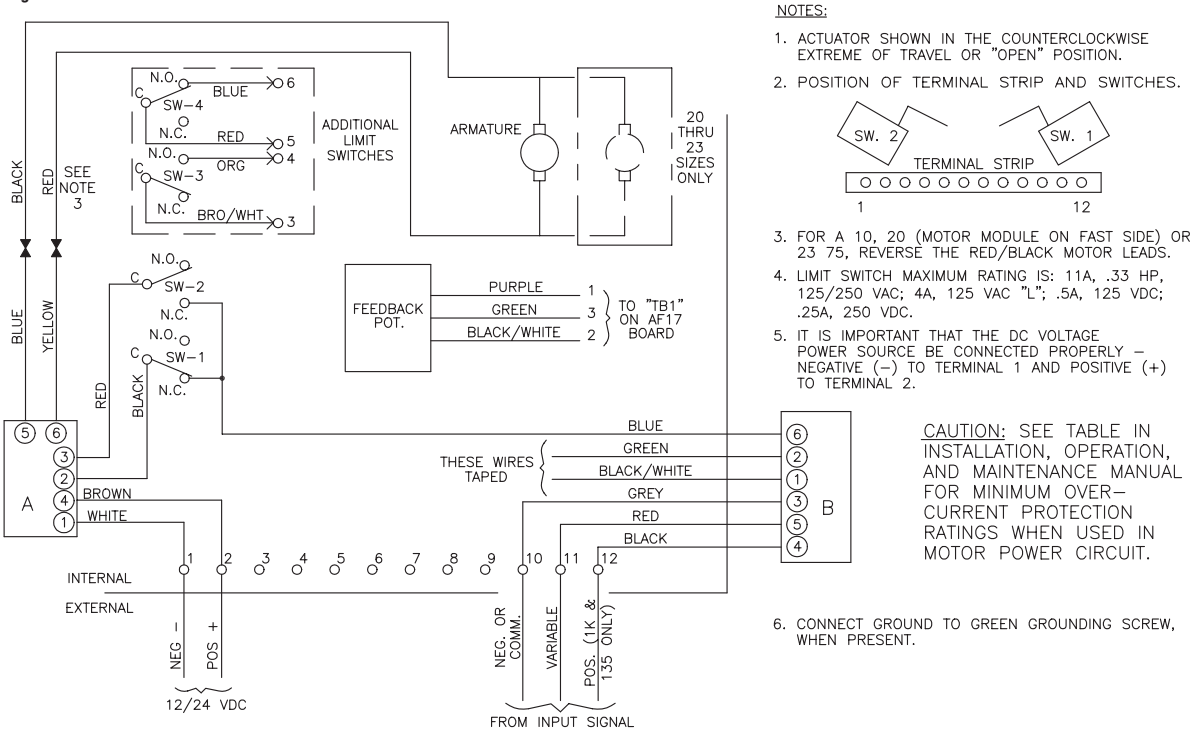
Refer to the AC AF-17 IOM for all other pertinent information.

Figure 2



ITEM	DESCRIPTION
1	Circuit Board Subassembly
2	Insulating Board
3	Bracket – Right (Long)
4	Grommet – Rubber
5	Mounting Screws (Circuit Board)
6	Washer-Nylon
7	Bracket-Left (Short)
8	Mounting Screws (Bracket)
9	Spacer (Bracket)

Figure 3



NOTES:

1. ACTUATOR SHOWN IN THE COUNTERCLOCKWISE EXTREME OF TRAVEL OR "OPEN" POSITION.
2. POSITION OF TERMINAL STRIP AND SWITCHES.

3. FOR A 10, 20 (MOTOR MODULE ON FAST SIDE) OR 23 75, REVERSE THE RED/BLACK MOTOR LEADS.
4. LIMIT SWITCH MAXIMUM RATING IS: 11A, .33 HP, 125/250 VAC; 4A, 125 VAC "L"; .5A, 125 VDC; .25A, 250 VDC.
5. IT IS IMPORTANT THAT THE DC VOLTAGE POWER SOURCE BE CONNECTED PROPERLY – NEGATIVE (–) TO TERMINAL 1 AND POSITIVE (+) TO TERMINAL 2.

CAUTION: SEE TABLE IN INSTALLATION, OPERATION, AND MAINTENANCE MANUAL FOR MINIMUM OVER–CURRENT PROTECTION RATINGS WHEN USED IN MOTOR POWER CIRCUIT.

6. CONNECT GROUND TO GREEN GROUNDING SCREW, WHEN PRESENT.

FLOWSERVE CORPORATION
FLOW CONTROL DIVISION
Worcester Actuation Systems
5114 Woodall Road
P.O. Box 11318
Lynchburg, VA 24506-1318 USA
Phone: 434-528-4400
Facsimile: 434-845-9736
www.flowserve.com

WCAIM2050 10/03 Printed in USA